

CLAIMS

What is claimed is:

1. A vibration-inhibiting flooring structure for use in a facility housing vibration-sensitive equipment:
 - a bearing floor for supporting the vibration-sensitive equipment;
 - a plurality of openings extending through said bearing floor, said plurality of openings configured to inhibit the propagation of vibrations across said bearing floor.
2. The vibration-inhibiting flooring structure of claim 1, wherein said plurality of openings form a regular array of openings having a shape selected from a group consisting of rectangular, square, trapezoidal, triangular, circular, and elliptical.
3. The vibration-inhibiting flooring structure of claim 1, wherein at least some of said openings are partially or completely filled with a vibration-dampening material.
4. The vibration-inhibiting flooring structure of claim 3, wherein said vibration-dampening material comprises a material selected from a group consisting of plastic, sponge, and rubber.
5. The vibration-inhibiting flooring structure of claim 3, wherein said vibration-dampening material preferentially inhibits one vibration mode over another vibration mode.
6. The vibration-inhibiting flooring structure of claim 1, wherein a subset of said plurality of openings includes an insert covering said opening.
7. The vibration-inhibiting flooring structure of claim 1, wherein a subset of said plurality of openings includes an air-impervious member.
8. The vibration-inhibiting flooring structure of claim 1, wherein said bearing floor is supported via a plurality of columns.

9. The vibration-inhibiting flooring structure of claim 8, wherein said plurality of columns are secured by footings which extend into the ground beneath a subfloor.

10. The vibration-inhibiting flooring structure of claim 8, wherein:
said columns include vertical reinforcing bar;
said bearing floor includes horizontal reinforcing bar; and
said vertical reinforcing steel bar is secured to said horizontal reinforcing bar.

11. The vibration-inhibiting flooring structure of claim 6, wherein said inserts are air-permeable, further including a wall-structure provided on said bearing floor to surround said subset of said plurality of openings.

12. The vibration-inhibiting flooring structure of claim 11, further including:
at least one filtered inlet above said subset of openings; and
air circulating equipment configured to effect the flow of air through said filtered air inlet and through said subset of openings.

13. The vibration-inhibiting flooring structure of claim 1, wherein said plurality of openings comprise a two-dimensional area which is between about 5% to 60% of the total two-dimensional area of said bearing floor which includes said openings.

14. The vibration-inhibiting flooring structure of claim 1, wherein said plurality of openings comprise a two-dimensional area which is between about 20% and 30% of the total two-dimensional area of said bearing floor which includes said openings.

15. The vibration-inhibiting flooring structure of claim 1, wherein said plurality of openings comprise a two-dimensional area which is about 25% of the total two-dimensional area of said bearing floor which includes said openings.

16. The vibration-inhibiting flooring structure of claim 1, further including a plurality of horizontal beams extending between two or more of said columns and incorporated into said bearing floor.

17. The vibration-inhibiting flooring structure of claim 1, wherein vibration testing, in accordance with generic vibration criterion (VC) testing, exhibits horizontal vibration amplitudes bounded by the VC-D curve and vertical vibration amplitudes bounded by the VC-B curve.

18. The vibration-inhibiting flooring structure of claim 2, wherein:
said plurality of openings comprise a regular array of square openings having two-foot sides and are arranged sixteen feet apart in an x direction and twenty feet apart in a y direction.

19. The vibration-inhibiting flooring structure of claim 18, wherein the thickness of said bearing floor is about two feet.

20. The vibration-inhibiting flooring structure of claim 1, wherein said bearing floor comprises poured-concrete.

21. A vibration-inhibiting flooring structure for use in a facility housing vibration-sensitive equipment, said flooring structure comprising:
a first series of horizontal reinforcing bars;
a second series of horizontal reinforcing bars perpendicular to and intersecting with, at a plurality of respective intersections, said first series of horizontal reinforcing bars;
a series of vertical reinforcing bars orthogonal to said first and second series of horizontal bars and secured to said first and second series of horizontal bars at one or more of said plurality of intersections;
a bearing floor comprising structural concrete formed around said first and second series of horizontal reinforcing bars, said bearing floor having a plurality of openings extending therethrough, said bearing floor capable of supporting said vibration-sensitive equipment;
one or more columns comprising structural concrete formed around said series of vertical reinforcing bars.

22. The vibration-inhibiting flooring structure of claim 21, wherein said plurality of openings form a regular array of a shape selected from a group consisting of rectangular, square, trapezoidal, triangular, circular, and elliptical

23. The vibration-inhibiting flooring structure of claim 21, wherein said series of vertical reinforcing bars are secured to a series of reinforcing bars provided in a set of footings, said set of footings further comprising structural concrete embedded in a surface below a subfloor.

24. The vibration-inhibiting flooring structure of claim 21, wherein said horizontal and vertical reinforcing bars comprise reinforcing steel bars manufactured in accordance with an ASTM standard selected from the group consisting of A615, A616, A617 and A706.

25. The vibration-inhibiting flooring structure of claim 21, wherein, at one of said intersections, four of said vertical reinforcing bars associated with said column are bent at approximately 90-degree angles with respect to the axis of said column and secured to said series of horizontal reinforcing bars at approximately 90-degree angles with respect to each other in the horizontal plane.

26. The vibration-inhibiting flooring structure of claim 1, wherein at least some of said openings are partially or completely filled with a vibration-dampening material.

27. The vibration-inhibiting flooring structure of claim 26, wherein said vibration-dampening material comprises a material selected from a group consisting of plastic, sponge, and rubber.

28. The vibration-inhibiting flooring structure of claim 26, wherein said vibration-dampening material preferentially inhibits one vibration mode over another vibration mode.

29. The vibration-inhibiting flooring structure of claim 1, wherein a subset of said plurality of openings includes an insert covering said opening.

30. The vibration-inhibiting flooring structure of claim 1, wherein a subset of said plurality of openings includes an air-impervious member.

31. A method of fabricating a vibration-inhibiting flooring structure capable of supporting vibration-sensitive equipment, said method comprising the steps of:

forming a subfloor;

forming a set of columns extending above said subfloor, said columns having a top surface;

providing a substantially planar floor form having a top side, a bottom side, and a set of cut-outs, said cut-outs corresponding in shape to the cross-section of said set of columns and corresponding in position to the position of said set of columns;

positioning said floor form such that said top side of said floor form is substantially coplanar with said top surface of said columns;

providing a plurality of structural forms on said top side of said floor form, said structures having a predetermined height;

forming a bearing floor on said top side of said floor form, said bearing floor having a thickness substantially equal to the height of said plurality of structural forms;

removing at least some of said structural forms, thus revealing a plurality of openings extending through said bearing floor.

32. The method of claim 31, wherein:

said step of forming said set of columns includes the step of forming structural concrete columns around a series of vertical reinforcing bars; and

said step of forming a structural concrete bearing floor includes the step of providing a mesh of horizontal reinforcing bars secured to said vertical reinforcing bars.

33. The method of claim 31, further including the steps of:

forming a set of footers within a surface below said subfloor;

securing said columns to said footers via a series of footer reinforcing bars secured to said vertical reinforcing bars of said set of columns.

34. The method of claim 31, wherein said positioning step includes the steps of:
providing a truss structure removably mounted to said subfloor;
mounting said bottom side of said floor form on said truss structure; and
removing said truss structure and said floor form after said step of forming said bearing floor.
35. The method of claim 31, wherein said step of forming said bearing floor includes the step of pouring structural concrete on said floor form.
36. The method of claim 31, wherein a portion of said plurality of structures have a height which is less than said predetermined height.
37. The method of claim 31, wherein said step of positioning said floor form includes the step of positioning said floor form such that said top side of said floor form is below said top surface of said columns by a distance equal to about 0.25 inches to about 6.0 inches.
38. The method of claim 31, wherein said step of forming said subfloor comprises the step of excavating a below-grade space.
39. The method of claim 32, further including the step of pouring structural concrete over said subfloor after said step of forming said footers.
40. The method of claim 31, further including the step of erecting a set of walls around the perimeter of said subfloor.
41. The method of claim 31, wherein said step of forming said columns includes forming a keyway in said top surface of said columns, and said step of forming said bearing floor includes the step of forming a mating key structure in said bearing floor.

42. A reconfigurable, vibration-inhibiting clean room facility capable of supporting vibration-sensitive equipment, said clean room facility comprising:

a perforated floor comprising a plurality of solid regions interposed with a plurality of openings configured in a regular array;

a facilities room located below said perforated floor;

a ceiling located above said perforated floor;

a clean room defined by a plurality of clean room walls moveably attached to said perforated floor and said ceiling, said clean room encompassing a first set of said openings;

a plenum area defined by at least one of said clean room walls and at least one second wall, said plenum area encompassing a second set of said openings disjoint from said first set of said openings;

cleaning apparatus configured to: force air from said clean room to said facilities room through said first set of openings; force air from said facilities room to said plenum area through said second set of openings; and force air into said clean room through said ceiling, wherein said air is cleaned prior to forcing said air into said clean room.

43. The clean room facility of claim 42, further including:

one or more filters in said ceiling above said clean room;

one or more blowers in said ceiling above said plenum.

44. The clean room facility of claim 42, further including a plurality of columns supporting said perforated floor.

45. The clean room facility of claim 42, wherein a portion of said openings includes an insert.

46. The clean room facility of claim 42, wherein said insert is air-permeable.

47. The clean room facility of claim 42, wherein a portion of said openings includes a removable air-impervious member.

48. The clean room facility of claim 42, wherein:
 said columns include vertical reinforcing bar;
 said perforated floor includes horizontal reinforcing bar; and
 said vertical reinforcing steel bar is secured to said horizontal reinforcing bar.

49. The clean room facility of claim 42, wherein said plurality of openings are arranged in a regular array of openings having a shape selected from a group consisting of rectangular, square, trapezoidal, triangular, circular, and elliptical.

50. The clean room facility of claim 42, wherein at least some of said openings are partially or completely filled with a vibration-inhibiting material.

51. The clean room facility of claim 42, wherein said plurality of openings comprise a two-dimensional area which is between about 5% to 60% of the total two-dimensional area of said perforated floor which includes said openings.

52. The clean room facility of claim 42, wherein said plurality of openings comprise a two-dimensional area which is between about 20% and 30% of the total two-dimensional area of said perforated floor which includes said openings.

53. The clean room facility of claim 42, wherein said plurality of openings comprise a two-dimensional area which is about 25% of the total two-dimensional area of said perforated floor which includes said openings.

54. A method of reconfiguring a vibration-inhibiting clean room facility, said method comprising the steps of:

providing a perforated floor comprising a plurality of solid regions interposed with a plurality of openings configured in a regular array;
 providing a facilities room below said perforated floor;
 providing a ceiling above said perforated floor;

defining a clean room by moveably attaching a plurality of clean room walls to said perforated floor and said ceiling, wherein said clean room encompasses a first set of said openings;

defining a plenum area adjacent said clean room, wherein said plenum area is defined by at least one of said clean room walls and at least one second wall, wherein said plenum area encompasses a second set of said openings disjoint from said first set of said openings;

providing cleaning apparatus configured to: force air from said clean room to said facilities room through said first set of openings; force air from said facilities room to said plenum area through said second set of openings; and force air into said clean room through said ceiling, wherein said air is cleaned prior to forcing said air into said clean room; and

relocating one of said clean room walls such that:

- (a) said clean room is expanded to encompass at least one of said second set of openings previously encompassed by said plenum area, or
- (b) said plenum area is expanded to encompass at least one of said first set of openings previously encompassed by said clean room.

55. The method of claim 54, further including the steps of:

providing, prior to said relocating step, one or more removable filters in said ceiling above said clean room;

providing, prior to said relocating step, one or more removable blowers in said ceiling above said plenum;

moving, after said relocating step, said filters and said blowers such that said filters are located over said clean room and said blowers are located over said plenum.